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ABSTRACT

This pamphlet addresses the problems associated with residuals and water quality especially as it relates to the National Water Pollution Control Program. The types of residuals and appropriate management systems are discuss 1. Additionally, one section is devoted to the role of citizen participation in developing management programs. (CS)

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Residuals Management and Water Pollution Control Planning

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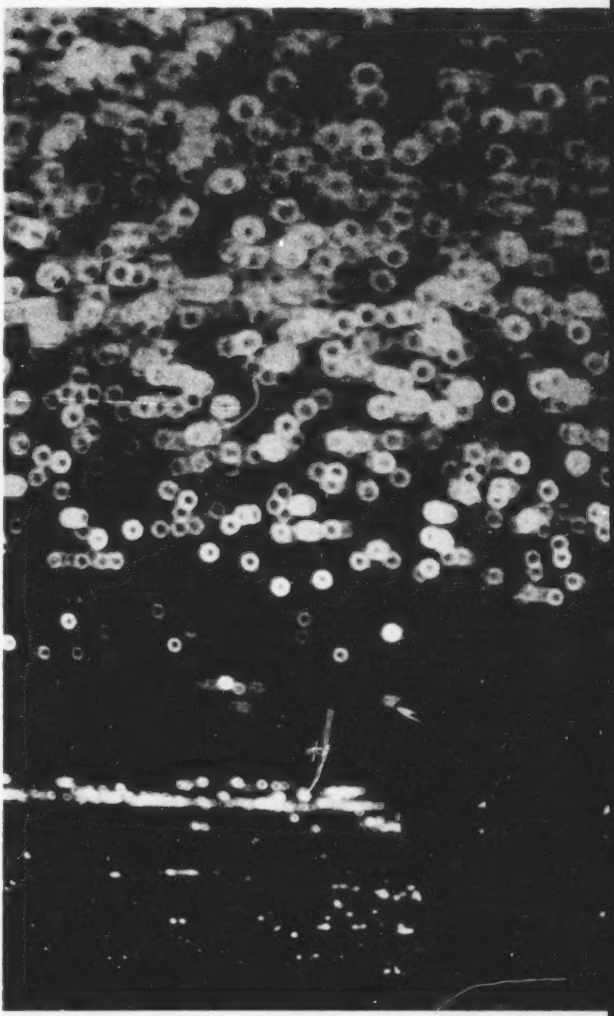
America's economic growth is a story of wealth and waste. Americans are the world's most economically productive people—the trillion dollar GNP is now a yearly event. And we are the world's most prolific producers of solid waste, more than seven billion tons of it every year. In the past we largely ignored these by-products of our prosperity, burying or abandoning them as if the earth could harmlessly absorb this massive load forever. Now we know better. Solid wastes, also known as residuals, pollute our waters, squander valuable resources, threaten health, and insult our sensibilities.



A National Water Pollution Control Program

In 1972 Americans entered a new period in protecting the Nation's waters with enactment of Public Law 92-500—the Federal Water Pollution Control Act Amendments (FWPCAA). A cooperative program between Federal and State governments, it is an ambitious and exacting effort to halt the growing deterioration of the country's water quality, including pollution of water associated with solid wastes.

Public Law 92-500 created, for the first time, a national water pollution control program. The law covers all navigable waters of the United States and has two broad purposes:

- By July 1983, to achieve, wherever possible, water clean enough to permit swimming and other recreational uses and to protect fish, shellfish, and wildlife.
- By 1985, to eliminate the discharge of any pollutants into the Nation's navigable waters.

The program contains several major elements. It expands State responsibilities for setting water quality standards designed to achieve the 1983 national goal of "fishable and swimmable waters." The law creates a national permit program to limit pollutants discharged by industry and municipalities into navigable waterways. It creates "national performance standards," applicable to all industrial and municipal dischargers, which establish minimum effluent treatment methods. State and Federal governments are required to control "nonpoint" pollution— that is, diffuse sources of water pollution such as stormwater runoff, sedimentation, and agricultural wastes. The law creates a comprehensive planning program at four levels to assure future control of water pollution: municipal, areawide, State, and regional. Most major programs have compliance deadlines. Finally, the law strongly encourages the control and reuse of solid wastes associated with water pollution. The effective management of these wastes is essential to achieving the broad goals of the new national program.

208 Planning

One of the most important programs in Public Law 92-500 is Areawide Waste Treatment Management, described in Section 208. This program, unique in Federal pollution legislation, is charged with developing a special strategy to deal with the complex pollution problems found both in urban-industrial areas and elsewhere in a given State. The 208 program requires State and local governments to work with EPA in planning and carrying out a variety of measures to identify, control, and reduce water pollution sources.

From the time its preliminary arrangements are approved by EPA, each 208 State and areawide agency has two years to draw up a water quality management plan for each designated area. This planning procedure is fully funded by Federal grants. The plans must accomplish specific goals.

These include:

A. Identifying all wastes generated in the area and all treatment works necessary to handle municipal and industrial wastes over the next 20 years;

B. Analyzing proposed alternative treatment systems, land acquisition needs, and the necessary collection and storm sewer systems, as well as developing a strategy for financing all elements of the treatment system;

C. Developing a regulatory program to control the modification and construction of municipal treatment works, ensuring that any industrial discharges entering these facilities meet pretreatment standards, and identifying the agencies responsible for such regulation; and

D. Creating procedures to control nonpoint sources of pollution, saltwater intrusion, the disposal of all wastes (including solid wastes in landfills), and the disposal of sewage sludge.

These 208 plans must be compatible with other State and local water resource plans required by Public Law 92-500.

Governors must identify the agencies responsible for implementing the 208 plans after their completion. The agencies are responsible for continually updating and modifying these plans to achieve the objectives of Section 208. The test of the program's success will be the feasibility of its plans. The program aims to translate Federal and State water quality standards into workable management strategies.

Nonpoint Pollution

Public Law 92-500 requires that all water quality management plans created under Section 208 contain provisions for controlling nonpoint pollution sources or activities. State and areawide 208 agencies must identify all the sources of such pollution within their jurisdiction and set feasible procedures and methods to control them. The plans must specifically deal with:

1. Agriculture and silviculture (forest management);
2. Mine-related wastes;
3. Construction; and
4. All other wastes that could affect water quality.

Beyond this, in order to protect ground and surface water quality, the law also requires that the plans provide for regulating the disposal of pollutants on land—a provision that may include nonpoint pollution sources not specifically identified elsewhere in the law.

The Resources Conservation Recovery Act.

Late in 1976, Congress enacted a new solid waste management law which is likely to influence the 208 program. The legislation, called the Resource Conservation and Recovery Act, requires that EPA work with

State and local governments to achieve more effective national waste control. By June, 1978, the generation, transportation, and disposal of all wastes identified by the EPA as hazardous must be regulated by permits issued through the States or the EPA.

The law also requires the States to prohibit the land disposal of solid wastes except in sanitary landfills after October, 1983. Other provisions require States to create plans for areawide management of solid wastes and for resource recovery where such planning is appropriate. Federal grants are authorized for planning and implementing this program. The goals of this new law are complementary to the approaches to waste management under Section 208. Elements of the new program may become part of the 208 planning process; in this case, some 208 State and areawide agencies may assume the responsibility for planning and implementing parts of this new program.

Residuals and Water Quality

EPA defines residuals as "those solid, liquid, or sludge substances from man's activities in the urban, industrial, agricultural, and mining environment not discharged to water after collection and necessary treatment." Residuals is a particularly apt term for such pollutants because they are leftovers. They may also be called solid waste although some residuals (sedimentation, for instance) do not accumulate in large waste piles where they may be easily discovered and examined. One common form of residual is familiar to almost all Americans: the materials ending up in the trash barrel and garbage dump. Most, however, are unseen or ignored by the average citizen—the sludges resulting from wastewater treatment, for example. Residuals directly affect present or future water quality in many of the Nation's most populous areas. Their control will be an important—and sometimes crucial—component in many 208 plans. Public Law 92-500 requires the regulation of residuals in water quality management plans whenever this waste is likely to degrade water quality.

The law spells out specific requirements for 208 planning agencies in this respect. For example, no sludge from a municipal treatment plant that would affect water quality may be disposed of without an EPA permit. Agencies must identify and control farm, silviculture, mine, and construction wastes contributing to water quality deterioration. They must also create processes to control disposal of residual waste and pollutants on land or in excavations to protect water quality.

This concern with residuals stems from an awareness of their great pollution potential. Sewage sludge, for instance, can be a potent water contaminant. When untreated sewage sludge is deposited in landfills (even in high quality sanitary landfills), a multitude of contaminants, including nitrogen compounds, coliform bacteria, and other organic materials, may leach into the soil and subsurface waters or affect surface water through runoff. Methane gas from the decomposition of organics in sludge may accumulate. Various toxics and pathogenic agents may breed in a decaying landfill and threaten public health. Sewage solids dumped at sea may contain pathogenic agents which contaminate shellfish.

Waste in landfills is more

Types of Residuals

than aesthetically repellent; rain, snow, and surface waters may wash from such debris a multitude of contaminants—including bacteria and viruses, suspended solids, nutrients, metals, pesticides, and persistent organic toxic compounds—all of which can find their way into rivers, streams, and lakes.

The need to control mine wastes, another major source of water degradation, will become increasingly imperative because surface mining for coal will vastly expand in the next decade. The spoil produced from coal surface mining contains many pollutants: iron pyrite ("fool's gold") that dissolves in surface and subsurface waters to produce sulfuric acid; heavy sedimentation, which creates turbidity and increases the danger of flooding by lowering the carrying capacity of stream beds; and various ferrous compounds, which poison plant and animal life.

Waste Treatment Sludges

Sludges are solids removed from waste water in community treatment plants that must be further treated to remove many harmful organisms.

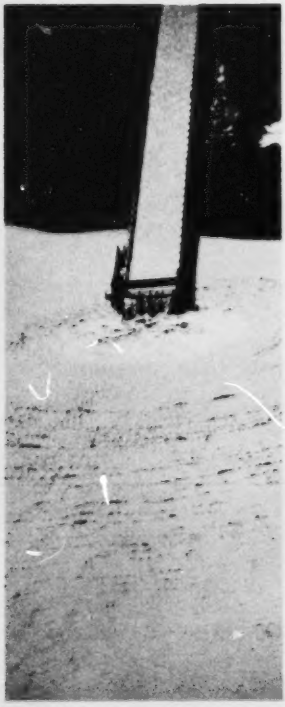
Sometimes they are treated anaerobically by bacteria which "digest" the sludge and remove most of the dangerous organisms. The harmful elements, together with most of the water, also may be removed by air drying or vacuum filtration in large drying drums. After it has been detoxified, the sludge either may be removed to a sanitary landfill, recycled in the water treatment system itself, used for land reclamation, deposited in waste disposal ponds, dumped in the ocean far offshore, or incinerated.

Residential and Commercial Wastes

These include glass, plastic and metal containers, food remnants, paper products, toothpaste tubes, discarded appliances, auto bodies, food industry processed wastes, and many other products. Most of these solid wastes are deposited in landfills, incinerated, or hauled to sea and dumped.

Industrial Sludges and Processed Wastes

Many industries treat their own waste waters and generate sludges. Industrial processed wastes also may include paper pulp, cinders, fly ash, combustible and noncombustible solids, toxic chemicals, metal scraps, lumber, used containers, and other materials.



Agriculture solid wastes

The largest volume of non-point pollution in the United States is the refuse from agriculture. Feedlots, pastures, grazing land, and other areas of animal husbandry produce enormous amounts of metabolic waste. Much of the fertilizer used in agriculture dissolves in runoff waters; plant debris, silviculture materials, herbicides, and other sources produce significant solid wastes. Even though these activities may not occur in urban areas, the materials carried from them by surface and underground waters may affect urban water quality.

Mine wastes

Mining, particularly surface mining, affects water quality adversely through sedimentation, the disruption of underground water systems, and the contamination of streams, lakes, and rivers by acid drainage from exposed mining wastes.

Sedimentation

Heavy sedimentation is caused by soil cultivation, timber cutting, strip mining, overgrazed pastures, road building and other construction activity. A construction site, for instance, may contribute 2,000 times more sediment than forested terrain and 200 times more than grassland.

A Growing Problem

In 1972, waste treatment facilities in the United States were producing sludge at a rate of about 4,700,000 dry tons a year; by 1985, this figure will rise to 6,655,000 tons. Processing and disposing of these sludges accounts for more than half the annual operating and maintenance costs of most wastewater treatment facilities. About a third of the capital cost of the average waste treatment facility can be attributed to sludge management equipment. Most of this cost is ultimately borne by taxpayers. Since most communities have given little attention in the past to recycling sludges or otherwise realizing some income from their reuse, this public investment in sludge management has seldom produced its full potential return. As the number and efficiency of community treatment facilities increase, sludge will constitute a steadily rising cost factor in community waste management programs.

Residential and commercial wastes also grow. The Nation's municipalities currently spend more than $5 billion yearly to haul away and process these wastes. These wastes, amounting to almost 17 times the volume of sludges produced in waste treatment facilities have seldom been managed imaginatively or efficiently. Customarily, they are hauled to landfills or buried at sea. Land for waste disposal, however, is becoming increasingly scarce and costly and sea disposal poses environmental problems.

Recovered Resources

Past management of sludges and solid wastes has imposed a double cost. There is the tangible treatment cost and also a lost income—in money, reusable materials, and energy—when these residuals are not recycled. One attractive alternative to ocean dumping or landfilling for waste treatment sludges might be their reuse as fertilizer. Sludges sometimes can be used for agriculture purposes because they contain useful plant nutrients such as nitrogen, phosphorous, and potassium. Some types of sludge may not be suitable for this purpose because they contain contaminants. The cost of preparing sludge as fertilizer may be prohibitive in some instances, but the possibilities have seldom been explored.

The recovery value in community garbage is potentially great. EPA estimates that from the 134 million tons of refuse thrown away by Americans each year, the following materials could be reclaimed:

- 11.3 million tons of iron and steel
- 860,000 tons of aluminum
- 430,000 tons of other metals (mostly copper)
- 13 million tons of glass

Managing Residuals: A "Best Management" Plan

• burnable organic materials equal to one-half million barrels of crude oil, or roughly 70% of the annual estimated yield of the Alaskan North Slope oil reserves.

The potential energy recoverable in common garbage is particularly notable when the Nation is becoming concerned about the future availability of fossil fuels and other energy sources. Not only can energy be generated by burning organic materials in garbage, but some metals can be obtained from residuals with less energy expenditure than is required for the initial mining and refining. For example, it takes 20 times as much energy to get a pound of aluminum from bauxite ore as from urban solid waste; a ton of steel obtained from recycled municipal waste requires almost three-quarters less electric power to produce than the same amount produced from iron ore.

Often, there are practical difficulties in recycling residential and commercial wastes. Recycling is by no means a panacea to be prescribed for every community seeking better ways of waste management. However, many urban areas are successfully recycling refuse. The City of San Diego recycles 200 tons of refuse daily; through a combustion process called "pyrolysis" it obtains one barrel of fuel oil from an average ton of refuse and, additionally, recovers 140 pounds of ferrous metals and 120 pounds of glass. St. Louis, Missouri, is converting much of its municipal waste into electricity. Sometimes a joint effort between government and industry can produce effective recycyling. The Boston North Shore System at Saugus, Massachusetts, burns 1,200 tons of refuse a day to generate steam. A private company built and operates the plant, which receives refuse from 10 municipalities under contract to produce a regular supply of combustible solid waste. Urban areas, especially, often generate the large volume of solid wastes and achieve the economies of scale necessary to make solid waste recycling attractive. This is particularly significant when considering recycling for residuals management in 208 planning.

Confronted with many kinds of residual wastes and a multitude of possible management strategies, 208 planners face an imposing problem: What procedures should be chosen? If control strategies for specific residuals are combined in different ways, the range of options will seem formidable. However, regulations developed to implement Public Law 92-500 somewhat simplify this task by providing some guidelines.

EPA regulations require that EPA and the States work together with 208 agencies to develop the "best management practice" (BMP) for residuals. A BMP is defined as "a practice, or combination of practices, that is determined by a State (or a State or areawide 208 agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality standards." This means that any residuals management strategy developed under 208 planning must meet at least four general tests:

1. It should manage pollution generated by nonpoint sources;

2. It should be compatible with water quality goals;

3. It should effectively prevent or reduce pollution; and

4. It should be practicable—that is, it should be designed with careful attention to technological, economic, and institutional factors.

As a practical matter, it should be able to meet the following objectives:

A. Reduction of water flows by eliminating promiscuous, illegal, or accidental dumping of wastes and preventing surface and ground water contamination from existing or planned land disposal operations.

B. Development of the most economical disposal plan.

C. Stabilization of wastes.

D. Reduction, recovery, and recycling.

E. Assure that the institutions will have proper authority, jurisdiction, personnel, and financing and that charges for residual waste disposal are related to the benefits of the services.

Best management plans will vary because communities have different problems and varying means for solving them. One community may reduce sewage sludge by selling a portion of it for commercial or farm use; another may find it more practical to dry, detoxify, and haul the sludge to a sanitary landfill. Both solutions may meet the BMP criteria.

EPA encourages innovation, flexibility, and imagination in the development of BMP's for residuals management. Past experience should not become the sole test of proposed strategies. Existing arrangements, laws, or governmental processes may need to be changed to permit improved practices. Management strategies also should encourage the flow of accurate information to the public and ample opportunity for public involvement. Planners should have an attitude of openness, responsiveness, and concern for creative approaches.

The Citizen's Part

There are sound reasons why Public Law 92-500 and EPA regulations insist that citizens be informed and helped when participating in the 208 planning process. Citizens can make a valuable contribution to residuals management in several ways:

A. They can help define the social impact of proposed programs.

Citizens know their community culture, interests, and sentiments. This insight can be invaluable to planners and public officials. Specifically, citizens can often suggest:

- how much a community is willing to pay, and how, for residuals management;

- what alternatives are preferred; and
- what "trade-offs" are acceptable.

In short, citizen involvement can keep the planning process practical and responsive to the community.

B. They can become an articulate, active constituency for a residuals management program.

Once citizens understand its importance, they can often keep public officials and planners alert to good residuals management. Elected officials are especially responsive to organized, vocal interests. Without citizen activity, it is easy for public officials and planners to defer to other problems.

C. They can help carry out programs.

When citizens can contribute to a residuals program, they are more likely to support it. Knowledgeable, concerned citizens help assure success.

Making such a contribution requires more than activity and interest. Citizens need, first, to become informed about the residuals problem in their community and about the work of 208 planning agencies.

Who Should Participate?

In nearly every community there are business, professional, minority, environmental, agricultural, service, labor, public interest groups. Contact with these groups can often lead to communication with more specialized interests.

In any metropolitan area, the number of groups affected by the 208 program will be large; in the Washington, D.C. metropolitan area, for instance, the areawide 208 agency has identified 116 existing organizations with a potential concern for local water quality management. Although it is unrealistic to suppose that all organizations affected in some manner by local water quality programs will wish to participate in the 208 program, many will wish to be informed about the program and some, once contacted, may develop an interest.

Getting Involved

Whom Do I Contact?

One route to gain information about public invovement in residuals planning is through the designated State or areawide 208 agency. These agencies must provide citizens with this information. Citizens will usually find the most useful agency contacts to be the Public Participation Coordinator and the Citizens Advisory Group.

Public Participation Coordinator

Most agencies have a staff member responsible for coordinating public involvement activity. This person may be called the "Public Participation Coordinator," "Public Involvement Officer," or something similar. This individual can ordinarily provide considerable material and other information. Often he/she can direct the citizen to others directly related to the citizen's interests.

Citizen Advisory Committee

This is composed of spokespersons for local interests. Members whose job is to evaluate the broad purposes, alternatives, and procedures for the 208 plan. This committee commonly assumes some responsibility for encouraging and assisting citizen involvement.

A Final Word

Few things affect us more directly than air and water quality. Residuals planning, like other elements in the 208 program, will help to shape our future environment. For the first time, this country has embarked upon a deliberate, ambitious effort to plan our environmental future in a manner that protects priceless natural resources for ourselves and coming generations. This will be a difficult, lengthy, often controversial, and costly endeavor. It is also an essential undertaking worthy of our interest and participation.

Useful References

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Some Significant Terms

activated-sludge process—use of biologically active sewage sludge to hasten the breakdown of organic matter in raw sewage during secondary treatment.

discharge of a pollutant—any addition of any pollutant to navigable waters from any point source; any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel.

effluent—a substance that flows out; the treated or untreated liquid that flows out of a waste treatment plant, a sewer, or an industrial outfall.

effluent limitation—any restriction (including schedules of compliance) established by a State or EPA on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean.

eutrophication—an aging process in lakes, during which the water becomes overly rich in dissolved nutrients, resulting in excessive development of algae and other microscopic plants causing a decline in levels of dissolved oxygen (DO).

ground water—water in the porous rocks and soils of the Earth's crust; a large proportion of the total supply of fresh water.

industrial user—any industry that introduces pollutants into public sewer systems and whose wastes are treated by a publicly-owned treatment facility.

land disposal method—advanced waste treatment that uses soil, air, plants, and bacteria to remove pollutants from waste water. It includes four basic processes: pretreatment to screen out large solids; chlorination and vegetation in the soil; spraying over cropland where vegetation and micro-organisms in the soil remove additional pollutants; and reclamation by wells or drain tiles.

landfill—any land site to which solid waste is hauled and dumped. Many landfills are neglected or poorly managed, resulting in considerable contamination of surface and ground waters by runoff. Odors, fires, vermin, and other pathogenic agents may also thrive in badly managed landfills.

navigable waters—the waters of the United States, including the territorial seas, and intrastate waters.

nonpoint source—any unconfined area from which pollutants are discharged into a body of water, i.e., agricultural runoff, urban runoff, and sedimentation from construction sites.

performance standard—a level of control for a given pollutant from a given source as defined by the EPA. Public Law 92-500 requires the EPA to specify what these "performance standards" shall be for major dischargers of pollutants into the Nation's navigable waters. A performance standard must be set by the EPA according to the "best available demonstrated control technology, process, operating methods, or other alternatives including, where practicable, a standard permitting no discharge of pollutants."

permit—a legally binding document issued by a State or Federal permit agency to the owner or manager of a point source discharge. The permit document contains a schedule of compliance requiring the permit holder to achieve a specified standard or limitation (by constructing treatment facilities or modifying plant processes) by a specified date. Permit documents also specify monitoring and reporting requirements to be conducted by the applicant. All permits issued are valid for a maximum of five years.

point source—any discernible, confined, and discrete conveyance, including . . . any pipe, ditch, channel, tunnel, conduit, well, discrete operations, or vessel, or other floating craft, from which pollutants are or may be discharged.

pollution—the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water making it less desirable for the propagation of balanced indigenous populations of fish, for recreation, industry, or wildlife uses.

pollutant—waste discharged into water including: dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste; but not including, sewage discharged from vessels nor material injected into wells in connection with the production of oil and gas.

pretreatment—any process used to reduce the pollutant load before the waste is introduced into a sewer system or delivered to a treatment plant.

receiving waters—bodies of water into which waste water effluents are discharged.

river basin—one of 267 major and minor basin areas drained by a river and its tributaries.

sanitary landfill—a site, used for the land disposal of refuse, managed so that nuisances or hazards to public health and safety are avoided. The refuse is confined to the smallest practical area, is reduced to the smallest practical volume and is covered with a layer of earth at the conclusion of each day's operation, or more frequently if necessary. Such landfill usually reduces the contamination of surface and ground waters resulting from waste disposal.

sewer—any pipe or conduit used to carry sewage or storm water to treatment plants or receiving waters.

sewer, combined—sewer that carries both waste water and storm water.

sewer, interceptor—a sewer which collects the sewage from the main and trunk sewers and carries them to points of treatment or discharge.

sludge—the solids removed from waste water by sedimentation and precipitation; often presents a problem of ultimate disposal.

toxic pollutants—a pollutant or combination of pollutants including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism either directly or indirectly cause death, disease, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), and physical deformities in such organisms and their offspring.

turbidity—a cloudiness or discoloration of water as a result of suspended solids. Most commonly, turbidity is caused by dissolved sediment and produces a "muddy" appearance.

water quality standard—a plan for water quality management specifying: the use (recreation, fish and wildlife propagation, drinking water, industrial, or agricultural) to be made of the water; criteria to measure and protect these uses; implementation and enforcement plans; and an antidegradation statement to protect existing water quality.

water quality criteria—the levels of pollutants that affect the suitability of water for a given use.